REMARKS

Reconsideration of this application, as amended, is respectfully requested.

ALLOWABLE SUBJECT MATTER

The Examiner's allowance of claim 15 is respectfully acknowledged.

THE OFFICE ACTION WAS IMPROPERLY MADE FINAL

In the Office Action, the Examiner has cited USP 6,663,206 ("Taylor") for the disclosure of the subject matter of claim 6. Previously, the Examiner cited USP 6,900,449 ("Bolash et al") for the disclosure of the subject matter of claim 6.

Bolash et al was removed as a reference against claim 6 by submitting an accurate English translation of JP 2002-304279, to show that claim 6 is entitled to the priority date of October 18, 2002, which is before the January 15, 2003 filing date of Bolash et al.

Accordingly, the new ground for rejection of claim 6 was necessitated by the removal of Bolash et al as a reference against claim 6.

As explained in MPEP 706.07(a), an Office Action may not be made final if it contains any new ground of rejection that was not necessitated by an amendment to the claim or that was not based on information submitted in an IDS during the period set forth in 37 CFR 1.97(c).

Since the new ground of rejection of claim 6 was necessitated by the removal of Bolash et al as a reference, it is respectfully submitted that the Office Action was improperly made final, and it is respectfully requested that the finality of the Office Action be withdrawn.

THE PRIOR ART REJECTION

Claims 19, 13 and 14 were rejected under 35 USC 103 as being obvious in view of the combination of USP 4,734,868 (newly cited "DeLacy") and USP 6,425,650 (previously cited "Walker et al"); and claims 2-12 and 16-18 were rejected under 35 USC 103 as being obvious in view of the combination of DeLacy, Walker et al and one or more of USP 6,315,382 (previously cited "Gudaitis et al"), USP 6,241,334 (newly cited "Haselby" referred to by the Examiner as USP 6,158,344), USP 6,663,206 (newly cited "Taylor"), USP 5,777,638 (newly cited "Salter et al"), USP 4,839,674 (previously cited "Hanagata et al"), USP 6,547,355 (newly cited "Shimada et al"), US 2002/0012027 (newly cited "Moon et al"), and USP 6,352,331 (previously cited "Armijo et al").

These rejections, however, are all respectfully traversed, as explained in detail hereinbelow.

According to the present invention as recited in independent claim 19, an inkjet recording apparatus is provided which comprises: a recording head including a plurality of nozzles aligned in a sub-scanning direction; a recording section to record an image on a recording medium by jetting ink droplets from the nozzles while moving the recording head in a main scanning direction; a mark recording section to record a mark on the recording medium using a predetermined nozzle; a mark detecting unit, which is mounted on the recording head at a position separated from the predetermined nozzle along the sub-scanning direction, to detect the mark; a recording medium feeding section to feed the recording medium in the sub-scanning direction; and a control section to control the recording medium feeding section to feed the recording medium for a predetermined distance, such that the recording medium feeding section feeds the recording medium until the mark detecting unit detects the mark and then feeds the recording medium for a distance remaining up to the predetermined distance based on a feeding amount by the recording medium feeding section.

With this structure, when an image is recorded (by nozzles jetting ink) on a recording medium, one of the nozzles is used to record a mark on the recording medium. The recording medium is fed from the position where the mark was recorded, and the mark detecting unit (which is positioned at a position separated from the nozzle used to make the mark) detects the mark. The distance by which the recording medium is fed is, for example, a distance "C." Then, the recording medium is fed by a distance "A" such that the recording medium is fed for a predetermined distance.

The distance C from the mark recording nozzle to the mark detecting unit is fixed, since both the nozzle and mark detecting unit are on the recording head. The distance A, moreover, is preferably short. And since the distance A is short, it is possible to feed the paper by the distance A + C with very small error.

In conventional image forming apparatuses, when it is necessary to feed the recording medium by a predetermined distance, a predetermined number of pulses is applied to a stepping motor to set the feeding distance, or the feeding distance is determined based on pulses from a rotary encoder coupled to a DC motor used to drive the movement of recording medium. Alternatively, a rotary encoder is installed on a rotating shaft of a feeding roller in a conventional image forming apparatus, and the feeding amount is controlled using pulses from the rotary encoder coupled to the shaft. However, each of these techniques for setting/controlling the feeding amount of the recording medium relies on indirectly measuring the feeding of the recording medium, and therefore may give erroneous results. See the Background of the Invention section of the specification.

By contrast, according to the claimed present invention, the feeding distance C is fixed and directly measured, while the feeding distance A is small. Therefore, the feeding error over the small distance A is small compared with the error when the entire feeding distance (i.e., A + C) is indirectly measured using conventional technology.

Thus, with the structure of the claimed present invention, since a large portion of the feeding distance is directly measured based on a fixed distance between the nozzle making the mark and the mark detecting unit, the total error in feeding the recording medium for the distance A + C can be reduced.

By contrast, where the total feeding distance (i.e. the number of nozzles in the feeding times the pitch of the nozzles) is extrapolated by counting pulses for the entire feeding distance, a large feeding error may result.

The structure of the present invention as recited in independent claim 19 makes it possible for the recording medium to be fed based only on the detection of the feeding amount (a more error-prone way of detecting the feeding amount) for only the short distance after the mark is detected.

It is respectfully submitted that the combination of DeLacy and Walker et al does not disclose, teach or suggest the features of the present invention as recited in amended independent claim 19.

Indeed, according to DeLacy, an elongated photosensor 50, which preferably is made up of a plurality of photosensitive elements, is used to detect the leading edge 60 that is projected onto the photosensor, and the photosensor 50 directly detects the movement of the leading edge 60 as it moves to the position at 61. That is, DeLacy discloses directly detecting movement of a leading edge 60 so as to directly measure the feeding distance.

By contrast, according to the present invention as recited in independent claim 19, a mark is made at one position, and the mark travels to a position where it is detected (it is not continuously monitored with the feeding of the paper). Once the mark is detected, the paper is then fed by an additional amount up to a predetermined distance based on a feeding amount by the recording medium feeding section.

Indeed, the Examiner has acknowledged that DeLacy does not disclose detecting a mark with a mark detecting unit at a position separated from the predetermined nozzle for making the mark in a sub-scanning direction.

Therefore, DeLacy does not disclose the relationship between the mark detecting unit and the nozzle at the separate position based on which the present invention functions.

It is respectfully submitted, moreover, that Walker et al discloses optically scanning incoming media using a blue-violet light to obtain diffuse and specular reflectance data, so as to recognize the incoming media, and new types of media can be recognized by the printing mechanism. It is respectfully submitted, however, that Walker et al does not disclose, teach or suggest the relationship between the nozzle position for making a mark and the position of the mark detecting unit in the manner of the present invention as recited in independent claim 19.

That is, even though Walker et al discloses a sensor 100 for detecting a type of media, Walker et al does not disclose, teach or suggest the relationship between a nozzle that makes a mark and the detecting unit on the recording head that detects the mark, and as pointed out above, DeLacy does not disclose this relationship by the Examiner's own admission.

It is respectfully submitted, therefore, that the present invention as recited in independent claim 19 clearly patentably distinguishes over the combination of DeLacy and Walker et al under 35 USC 103.

Claim 2

The Examiner has cited Gudaitis et al with respect to the subject matter of claim 2. According to Gudaitis et al, paper is first driven to position a desired print position on the paper in the vicinity of a printhead at a relative fast speed. Since the fast feeding of the print medium is inaccurate, according to Gudaitis et al the print medium is then driven at a low speed to match the desired print position to the nozzles of the printhead. It is respectfully submitted, however, that adjusting feeding speed to perform printing does not correspond to adjusting the feeding speed to detect the mark, as recited in claim 2.

Claim 3

With respect to claim 3, it is again respectfully submitted that Tayuki et al merely discloses a memory for storing control parameters, including the position of pixels that are to be formed during each primary scan and the feed of the sub-scan (column 3, lines 8-11, cited by the Examiner).

That is, Tayuki et al merely discloses storing "the feed of the sub-scan." It is respectfully submitted that Tayuki et al does not relate to detecting a mark, and therefore clearly does not suggest feeding the recording medium based on a previously stored feeding amount when a mark detecting unit can not detect a mark, as recited in claim 3.

Claim 4

With respect to claim 4, the Examiner contends that Fig. 10 of Haselby shows "marks that are detected by the optical sensor;

[and] the feeding distance to the mark is less than the overall feeding distance of the recording medium."

The Examiner contends, moreover, that the combination of Haselby with DeLacy would have been obvious "in order to provide a higher level of sensor accuracy."

It is respectfully submitted, however, that the Examiner has failed to make any connection based on the disclosure of Haselby between sensor accuracy and the relationship between feeding distance to the mark and the feeding amount by which the recording medium is to be advance. And it is respectfully submitted, therefore, that the Examiner has not pointed to any teaching that would suggest that DeLacy should be modified based on Haselby to achieve the subject matter of claim 4.

In addition, it is respectfully pointed out that Fig. 10 of Haselby merely shows a vertical calibration line, and contains no disclosure relating to a feeding distance to the calibration line or a feeding distance by which the recording medium is to be advanced (or any advantages thereof).

Claim 5

According to claim 5, the inkjet recording apparatus of the present invention further comprises a feeding amount detecting section which detects the feeding amount by the recording medium feeding section, and the recording medium feeding section comprises a changeover section which switches the inkjet recording apparatus between a mode in which a feeding amount of the recording medium is determined based on a position where the mark detecting unit detects the mark, and a mode in which the feeding amount of the recording medium is determined based on only a detection signal from the feeding amount detecting section.

The Examiner has cited Haselby with respect to claim 5. It is respectfully submitted, however, that the reference numerals referred to by the Examiner (12, 21 and 76) do not, in fact, exist in Haselby, nor do the cited columns and lines of Haselby appear to relate to the subject matter attributed to them by the Examiner.

And it is respectfully submitted, in any event, that Haselby does not disclose the features of the present invention as recited in claim 5.

Claim 6

The Examiner contends that Taylor discloses a recording medium detecting section as recited in claim 6.

The sensor 35 of Taylor, however, detects marks 33 on a platen 25, and based on this detection, determines the position of the paper ("fluid receiving substrate") 30. And, contrary to the Examiner's assertion, Taylor contains no suggestion that the sensor 35 is used to detect whether the paper is present at all.

Therefore, it is respectfully submitted that Taylor does not disclose, teach or suggest a recording medium detecting section which detects whether or not the recording medium is present based on an output of the mark detecting unit, as according to the present invention as recited in claim 6.

As motivation for combining Taylor and DeLacy, moreover, the Examiner contends that modifying DeLacy in view of Taylor to achieve the features of claim 6 (if the subject matter of claim 6 were even found in Taylor) would be desirable "to improve sensor accuracy." It is respectfully submitted, however, that the Examiner has failed to indicate how determining whether a recording medium is present based on an output of a sensor improves the accuracy of the sensor. And it is respectfully submitted that the Examiner has not pointed to any teaching that would suggest that DeLacy should be modified based on Taylor to achieve the subject matter of claim 6.

Claim 9

The Examiner continues to assert that marks 9-12 in Fig. 4 of Hanagata et al are upstream of the area which is upstream, in the sub-scanning direction, of an area on which the main scanning of the recording head performs the recording.

However, marks 9-12 in Fig. 4 of Hanagata et al are clearly adjacent to the record area A in which the image is recorded. Therefore, the marks 9-12 are not upstream of the area in which the main scanning of the recording head performs the recording.

Claims 10 and 11

According to the present invention as recited in claim 10 and claim 11 depending therefrom, the recording head comprises a plurality of heads, and among the plurality of heads, the head that includes the predetermined nozzle is shifted by one nozzle interval from the other heads, in the sub-scanning direction.

The Examiner refers to Fig. 3 of Shimada et al as disclosing this feature of the present invention. However, Fig. 3 of Shimada et al shows actuators 61-64 that are adjacent in the main scanning direction (the cartridge moving direction) and Fig. 3 of Shimada et al contains no information with respect to the alignment of the actuators in the sub-scanning direction. Indeed, Fig. 4 of Shimada et al, which does show the alignment of the actuators in the sub-scanning direction, shows that the actuators are perfectly aligned both in the main scanning and sub-scanning directions.

In addition, Shimada et al does not disclose a particular nozzle to eject ink to make the mark that is detected by the mark detecting unit. Therefore, even if Shimada et al did disclose a printhead that was offset by one nozzle interval with respect to the others, Shimada et al could not suggest that the offset printhead was the printhead having the predetermined nozzle for making the mark.

As motivation for combining Shimada et al with DeLacy, moreover, the Examiner cites an improvement of printing quality. It is unclear, however, why the Examiner has linked an improvement in print quality to offsetting a printhead by one nozzle interval.

Claim 12

Claim 12 depends from claim 10, which patentably distinguishes over the cited references as explained above.

In addition, claim 12 recites that the mark recording section prevents nozzles adjacent to the predetermined nozzle (which makes the mark) from ejecting ink by controlling the nozzles to be zero filling with ink.

The Examiner has cited Moon et al for the disclosure of preventing nozzles from filling with ink.

However, it is respectfully pointed out that it is not enough for the Examiner merely to cite a reference that discloses preventing nozzles from filling with ink. Claim 12 recites that the nozzles adjacent to the predetermined nozzle (i.e. the nozzle that makes the mark) are prevented from ejecting ink.

Therefore, even if Moon et al discloses preventing nozzles from ejecting ink by controlling the nozzles to be zero filling with ink, Moon et al does not disclose a nozzle for making a mark, and therefore clearly cannot suggest a mark recording section that prevents nozzles adjacent to the predetermined nozzle (which makes the mark) from ejecting ink, as according to the present invention as recited in claim 12.

Claims 16 and 17

Claim 16 recites that the mark is yellow, and claim 17 recites that the mark detecting unit comprises a light emitting element that emits light to the recording medium and a light detecting element that detects light reflected from the recording medium, wherein the light emitting element comprises a blue LED, and the light detecting element is sensitive to blue.

Armijo merely discloses detecting nozzle test patterns, and that a blue LED is used to illuminate the test pattern when the pattern is yellow.

It is respectfully submitted that the merely existence of a yellow test pattern in Armijo does not suggest that the mark of DeLacy should be yellow.

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In view of the foregoing, it is respectfully submitted that the present invention as recited in each of independent claim 19 and claims 2-14 and 16-18 depending therefrom clearly patentably distinguishes over DeLacy and Walker et al, taken singly or in combination with any of the other cited prior art references of record, under 35 USC 103.

Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned for prompt action.

Respectfully submitted,

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